SCHEME OF COURSE WORK

Course Details:

Course Title	**Advanced Non-Destructive Testing Techniques L T P C 3 0 0 3**
Course Code	**19ME2161**
Program	**M. Tech**
Specialization	**CAD/CAM**
Semester	**II**
Prerequisites	**…….**
Courses to which it is a prerequisite	**------**

Course Outcomes (COs):

At the end of the course a student will be able to

CO	Course Outcomes	Cognitive Level
CO1	Identify various surface flaws by using LPI and MPI.	Remember , Understand , Apply
CO2	Apply the systematic understanding of knowledge on radiography and ultrasonic techniques.	Remember , Understand , Apply
CO3	Demonstrate comprehensive understanding of acoustic emission techniques.	Remember , Understand , Apply
CO4	Summarize conceptual understanding of principles of thermograph	Remember , Understand , Apply
CO5	Summarize the various techniques of optical holography and speckle metrology.	Remember , Understand , Apply

Program Outcomes (POs):

At the end of the program, the students in CAD/CAM will be able to

1. acquire fundamentals in the areas of computer aided design and manufacturing
2. apply innovative skills and analyze computer aided design and manufacturing problems critically
3. identify, formulate and solve design and manufacturing problems
4. carry out research related to design and manufacturing
5. use existing and recent CAD/CAM software
6. collaborate with educational institutions, industry and R&D organizations in multidisciplinary teams
7. apply project and finance management principles in engineering projects
8. prepare technical reports and communicate effectively
9. engage in independent and life-long learning and pursue professional practice in their specialized areas of CAD/CAM
10. exhibit accountability to society while adhering to ethical practices
11. act independently and take corrective measures where necessary

Course Outcome Versus **Program Outcomes:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	S	S	M	S	M				M		
CO2	S	S	M	S	M				M		
CO3	S	S	M	S	M				M		
CO4	S	S	M	S	M				M		
CO5	S	S	M	S	M				M		

S - Strongly correlated, *M - Moderately* correlated, *Blank - No correlation*

Assessment Methods:	Assignment / Quiz / Seminar / Case Study / Mid-Test / End Exam

Teaching-Learning and Evaluation

Week	TOPIC / CONTENTS	Course Outcomes	Sample questions	TEACHING LEARNING STRATEGY	Assessment Method &Schedule
1	LPI: Characteristics of liquid penetrants - different washable systems, developers- applications	CO1	Explain the importance and steps carried out in liquid penetrate test as a non-destructive Testing method	Lecture Discussion	Assignment-I (Week 8) Mid-I (Week 9)
2	MPI: Methods of production of magnetic fields- principles of operation of magnetic particle test applications- advantages and limitations	CO1	What are the different types of currents used in magnetic particle inspection?	Lecture Discussion	Assignment-I (Week 8) Mid-I (Week 9)
3	Radiography: Sources of ray X-ray production-properties of gamma rays and X-rays, film characteristics, exposure charts, contrasts. operational characteristics of X- ray equipment and applications	CO2	Explain the operational Characteristics of X-ray equipment for non-destructive testing	Lecture Discussion	Assignment-I (Week 8) Mid-I (Week 9)

4	Industrial Computed Tomography (CT): Computed Tomography, X-Ray detectors - CT image reconstruction algorithm - Capabilities, comparison to other NDT methods - industrial CT applications, CT System design and equipment	CO2	What do you understand by Industrial Computer Tomography? Explain	Lecture Discussion	Assignment-I (Week 8) Mid-I (Week 9)
5	Ultrasonic techniques: Production of ultrasonic waves types of waves - general characteristics of waves pulse echo method A, B, C scans.	CO2	Discuss A, B, C scans	Lecture Discussion	Assignment-I (Week 8) Mid-I (Week 9)
6	Acoustic emission techniques: Principles of acoustic emission techniques advantages and limitations - instrumentation applications	CO3	What instrumentation is used in acoustic emission test? Explain.	Lecture Discussion	Assignment-I (Week 8) Mid-I (Week 9)
7	Acoustical Holography: Liquid Surface Acoustical Holography - Optical System, Object size and shape, sensitivity and resolution, commercial liquid surface equipment Scanning Acoustical Holography - Reconstruction, Object size, Sensitivity and resolution,	CO3	Explain the differences between scanning acoustical holograph y and liquid surface acoustical holograph y	Lecture Discussion	Assignment-I (Week 8) Mid-I (Week 9)
8	Commercial Scanning equipment - Comparison of liquid surface and scanning systems, Read out methods, calibration, Interpretation of results - Applications - Inspection of welds in thick materials.	CO3	Describe the general equipment used for holography	Lecture Discussion	Assignment-I (Week 8) Mid-I (Week 9)
9	**MID-I**				

10	Principles of Thermography: Contact and non-contact inspection methods	CO4	Explain the principles of thermography	Lecture Discussion	Assignment-II (Week 17) Mid-I (Week 9)
11	Heat sensitive paints - Heat sensitive papers - thermally quenched phosphors	CO4	Describe heat sensitive paints	Lecture Discussion	Assignment-II (Week 17) Mid-II (Week 18)
12	liquid crystals - techniques for applying liquid crystals - calibration and sensitivity - other temperature sensitive coatings	CO4	What are temperature sensitive coatings	Lecture Discussion	Assignment-II (Week 17) Mid-II (Week 18)
13	Non-contact thermographic inspection - Advantages and limitations - infrared radiation and infrared detectors, Instrumentations and methods, applications.	CO4	Describe the advantages and disadvantages of non-contact thermo-graphic inspection.	Lecture Discussion	Assignment-II (Week 17) Mid-II (Week 18)
Optical Holography and Speckle Metrology					
14	Laser fundamentals coherence types of lasers holography, recording and reconstruction	CO5	Write the principles of operation of lasers. Explain different types of Lasers and their applications.	Lecture Discussion	Assignment-II (Week 17) Mid-II (Week 18)
15	holographic interferometry, real-time, double-exposure & time-averaged techniques holographic NDT	CO5	What is holography? Explain in detail holographic interferometry?	Lecture Discussion	Assignment-II (Week 17) Mid-II (Week 18)
16	methods of stressing and fringe analysis typical applications requirements	CO5	Explain advantages and diaadvantages of holographic interferometry	Lecture Discussion	Assignment-II (Week 17) Mid-II (Week 18)

	advantages and disadvantages				

17	laser speckle metrology basics electronic speckle pattern interferometry (ESPI) shearography applications.	CO5	Explain electronic speckle pattern interferometry.	Lecture Discussion	Assignment-II (Week 17) Mid-II (Week 18)
18	**Mid-II**				
19	**End Semester**				